(12) UK Patent Application (19) GB (11) 2 299 999 (13) A

(43) Date of A Publication 23.10.1996

(21) Application No 9608190.6

(22) Date of Filing 19.04.1996

(30) Priority Data
(31) 07096681 (32) 21.04.1995 (33) JP
07171863 07.07.1995

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(51) INT CL[6]
A63B 37/12

(52) UK CL (Edition O)
C3V VEM
C3M MXC M104 M119
C3W W209 W213 W225 W227 W308 W311
U1S S1156

(56) Documents Cited
GB 2292387 A GB 2278609 A GB 2248067 A
US 4919434 A

(58) Field of Search
UK CL (Edition O) C3M MXC , C3V VEM
INT CL[6] A63B
Online: WPI

(54) Golf ball having two-layer cover structure

(57) The golf ball comprises a core and a cover formed on the core, wherein the cover has a two-layer cover structure of a hard inner cover layer and a soft outer cover layer, and the inner cover layer comprises a high-rigid polyamide resin in an amount of not less than 5% by weight based on the total weight of the inner cover resin. The layers may comprise ionomers.

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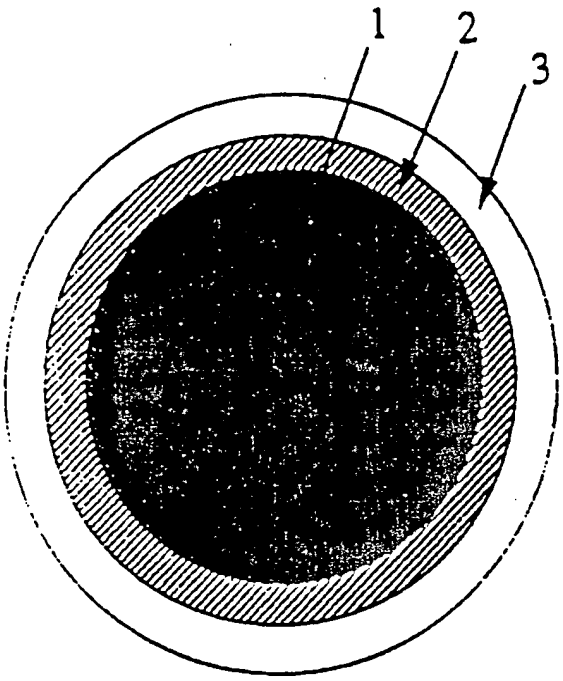
Fig. 1



GOLF BALL HAVING TWO-LAYER COVER STRUCTURE

The present invention relates to a golf ball. More particularly, it relates to a golf ball having a two-layer cover structure of a hard inner layer and a soft outer layer, wherein a flight distance obtained by using a driver or iron are increased and an ease of stopping at the time of approaching is improved.

In the prior art, there are mainly two kinds of golf balls. One golf ball is a solid golf ball(e.g. solid tow-piece golf ball, etc) comprising a core of an integrated rubber member and a cover of a thermoplastic resin (e.g. ionomer resin, etc.) covered on the core. Another golf ball is a thread wound golf ball, which is produced by winding rubber thread around a solid or liquid center, followed by covering with a cover of an ionomer resin or balata having a thickness of 1 to 2 mm. The solid golf ball attains a large ball velocity at the time of hitting in comparison with the thread wound golf ball and, therefore, a trajectory referred to as a straight ball is obtained when using a driver or iron and the flight distance is longer. On the other hand, the solid golf ball attains a large ball velocity at the time of hitting and has small spin amount because the contact area between the golf ball and hitting surface is small. Therefore, a spin is not easily put and the golf ball is not easily stopped. Accordingly, a golf ball having excellent spin characteristics at the time of approaching using the iron while maintaining

a large flight distance as a characteristic of the solid golf ball is requested. Accordingly, a trial of accomplishing the above object by using the soft resin for the outside of the cover layer (e.g. high-spin two-piece golf ball, etc.) has been made, recently. When the outer cover layer is softened, the spin amount increases at the time of approaching and the golf ball is easily stopped. However, the ball velocity at the time of hitting is drastically lowered and the flight distance obtained by using the driver and iron is inferior to a conventional solid golf ball.

In order to accomplish the above object, Japanese Laid-Open Patent Publication No. 6-343718 tried to increase flight distance by using a high-acid ionomer resin for an inner cover layer in a golf ball having a multi-layer structure (comprising a ball center (core), an inner cover layer and an outer cover layer). Even if the hard (high-rigid) high-acid ionomer resin is used for the inner cover layer, there is a limitation in increase of the ball velocity because of it's soft outer cover layer. It is necessary to make the inner cover layer harder, thereby increasing the ball velocity.

In order to accomplish the above object, the present invention have studied intensively. As a result, it has been found that, when using a polyamide resin in the amount of not less than 5% by weight based on the total amount of the resin of the composition in combination with an ionomer resin for the inner cover layer of the above-described golf ball having a two-layer cover structure, the resulting cover has high rigidity and high elasticity in comparison with the high-acid ionomer resin. It has also been found that, even if a soft ionomer resin having a stiffness of 1000 to 2500 kg/cm2 and a Shore-D scale hardness of 56 to 64, preferably 60 to 63 is

used for the outer cover layer, a decrease in rebound characteristics of the golf ball is prevented and the resulting golf ball is launched higher than the golf ball using the high-acid ionomer resin for the inner cover layer of the prior art, thereby increasing the flight distance of the golf ball while improving spin performances at the time of approaching. Some golf balls of the prior art use a thermoplastic material containing a block copolymer of polyamide for the inner cover layer (Japanese Laid-Open Patent Publication No. 4-244174). However, polyamide used in the present invention is a simple substance while the prior art uses a high-rigid random copolymer (a block copolymer may be mixed, partially), not low-rigid block copolymer.

That is, a main object of the present invention is to provide a golf ball having a two-layer cover structure of a hard inner layer and a soft outer layer wherein a flight distance by using obtained a driver or iron are increased and an ease of stopping at the time of approaching is improved.

This object as well as other objects and advantages of the present invention will become apparent to those skilled in the art from the following description with reference to the accompanying drawing.

Fig. 1 is a schematic cross section illustrating the golf ball of the present invention.

The present invention provides a golf ball comprising a core (1) and a cover formed on the core, wherein the cover has a two-layer cover structure of a hard inner cover layer (2) and a soft outer cover layer (3), and the inner cover layer (2) comprises a high-rigid polyamide resin in an amount of not less than 5% by weight based on the total weight of the resin.

Hereinafter, the present invention will be described in detail. In the golf ball of the present invention, cover layers (2 and 3) of a two-layer structure are formed on a core (1). The core may be a solid core for the above solid golf ball, or a thread core for the thread wound golf ball. The solid core includes a single layer core and a two-layer core. In case of the two-layer core, it is preferred that an inner nuclear has a diameter of 24 to 32 mm and a JIS-C hardness of 50 to 80 and a JIS C hardness of a jacket (referred to as outer nuclear, sometimes) covered on the inner nuclear is 10 larger than that of the inner nuclear. When a comparison between the two-layer core and single-layer core is made, the two-layer core is softer in feeling than the single layer at the same core hardness (deformation formed under load of 10 to 130 kg) and shows good rebound characteristics. The solid core is obtained by subjecting a rubber composition to vulcanization molding. The suitable rubber composition for solid core comprises base rubbers (e.g. hi-cis polybutadiene, etc.), co-crosslinking agents (e.g. zinc (meth)acrylate,etc.), organic peroxides, fillers,

etc. The solid or liquid center part for thread wound core is obtained by vulcanizing the same rubber composition as that of the solid core. As the liquid center, those obtained by enclosing a paste comprising viscosity adjustors, specific gravity adjustors and water in a bag are suitably used. The thread rubber to be wound around the center part is obtained by vulcanizing a natural rubber, synthetic isoprene rubber, etc. The core (1) generally have a diameter of 30 to 39, preferably from 33 to 37.5 mm. The core hardness (deformation formed when applying a load within the range from 10 to 130 kg) is preferably 3.7 to 5.0 mm. When it is smaller than 3.7, the hardness of the golf ball itself is large and hit feeling is inferior (feel hard). On the other hand, when it is larger than 5.0, the rebound characteristics as the golf ball is lowered and the flight distance is decreased.

A conventional two-piece golf ball is obtained by covering a single-layer cover on the above core (1). Regarding the golf ball of the present invention, this cover has a two-layer structure and it comprises an inner cover layer (2) and an outer cover layer. The inner cover layer (2) contains a polyamide resin in an amount of not less than 5% by weight, preferably from 5 to 50% by weight, based on the total amount of the resin components. Examples of the polyamide resin include those comprising a polyamide skeleton as a main part, such as nylon 6, nylon 11, nylon 12, etc. The block copolymer wherein the other skeleton (e.g. polyester skeleton, etc.) is introduced in the polyamide skeleton shows low rigidity because the skeleton to be introduced generally has a rigidity smaller than that of polyamide, and it is not preferred. The polyamide resin preferably

have a stiffness of 10,000 to 18,000 kg/cm^2. As far as the stiffness is within this range, a low-rigidity block copolymer may be formulated. The other resin component constituting the inner cover layer (2) is an ionomer resin, and examples thereof include known ionomer resins which are generally used for the cover of the golf ball. Examples of the ionomer resin include Hi-milan #1706 and #1707 (trade name) which are commercially available from Mitsui Polychemical Co., Ltd.), IOTEK 8000 which is commercially available from Exxon Co., etc. In the present invention, by using this ionomer resin in combination with the high-rigid polyamide resin, the resulting golf ball can attain the rigidity and elasticity which are higher than those of the conventional golf ball using a hard high-acid ionomer resin. The stiffness of the total inner cover is preferably from 4,000 to 8,000 kg/cm^2, more preferably from 5,000 to 8,000 kg/cm^2. It is preferred that the cover has a Shore-D scale hardness within the range of 65 to 90. The amount of the polyamide resin and ionomer resin is adjusted so that the stiffness and Shore D-scale hardness of the whole inner cover are satisfied. The formulation ratio by weight of both resins (polyamide resin/ionomer resin) which are practically used, varies largely depending on the kind of the resin used, for example, it is within the range of 5:95 to 70:30, preferably 10:90 to 60:40.

The resin component of the outer cover layer (3) comprises an ionomer resin, and examples thereof include known resins which are generally used for the cover of the golf ball. It is preferably a soft (low-rigid) ionomer resin having a stiffness of 1000 to 2500 kg/cm^2 and a shore-D scale hardness of 56 to 64, preferably 60 to 63. Examples thereof include

Hi-milan #1650 and #1855 (trade name) which are commercially available from Mitsui Polychemical Co., Ltd. When the stiffness exceeds 2500 kg/cm^2, spin characteristic is poor and an ease of stopping on the green is liable to be deteriorated. On the other hand, when it is smaller than 1000 kg/cm^2, the rebound characteristics of the golf ball itself are deteriorated and the flight distance is decreased, sometimes.

The cover layer (inner cover layer (2) and outer cover Layer (3)) in the present invention may contain, for example, colorants (e.g titanium oxide, etc.) and other additives such as ultraviolet absorbers, photostabilizers, fluorescent materials or fluorescent brighteners, etc. unless desired characteristics due to the golf ball cover are deteriorated.

The cover layer in the present invention is formed by known methods which are used for forming the cover of the golf all, for example, injection molding, press molding, etc. Firstly, the inner cover (2) is covered on the core (1), and then the outer cover (3) is covered thereon. In case of covering the outer cover (3), a lot of recesses referred to as dimples are formed on the surface. The thickness of both outer and inner cover layers is preferably within the range of 0.5 to 2.3 mm. In order to enhance appearance and commercial value, the golf ball of the present invention is generally put on the market after coating with paint.

According to the present invention, there is provided a golf ball wherein the flight distance obtained by using the driver and iron is increased and ease of stopping at the time of approaching is improved because the golf ball has a two-layer cover structure of the above hard inner cover layer (2) and soft outer cover layer (3).

The golf ball of the present invention is superior in hit feel and spin characteristics and improved ease of stopping (particularly, at the time of approaching) while maintaining an essential flight distance of a solid golf ball.

EXAMPLES

The following Examples further illustrate the present invention in detail but are not to be construed to limit the scope thereof.

(i) Core formulation (The following core formulation was kneaded and then subjected to vulcanization molding to obtain a spherical core having a diameter of 35.5 mm ϕ).

Component	Amount (parts by weight)
BR-18 (note 1)	100
Zinc acrylate	26
Zinc oxide	29.9
Antioxidant (note 2)	0.5
Dicumyl peroxide	2.0
Balnoc R (note 3)	0.5

Core hardness: 4.3 mm

Vulcanizing conditions: 145°C, 35 minutes

(ii) Inner cover layer formulation (Resins were blended in the following proportion to obtain the following stiffness. The resulting cover formulation was covered on the core obtained in the above item (i) in a thickness of 1.7 mm.)

Component	Amount (parts by weight)			
	A	B	C	D
AM7317 (note 4)			50	
AM7318 (note 4)			50	
Hi-milan #1706 (note 5)	45	40		50
Hi-milan #1707 (note 5)	45			50
Nylon 12 (AMNO)	10	20		
IOTEK 8000 (note 6)		40		
Stiffness (kg/cm^2)	4350	5090	4300	3615
Shore-D scale hardness	67	69	67	65

(ii) Outer cover layer formulation (Resins were blended in the following proportion to obtain the following stiffness. The resulting cover formulation was covered on the cover obtained in the above item (ii) in a thickness of 1.9 mm.)

Component	Amount (parts by weight)		
	a	b	c
Hi-milan #1650 (note 7)	50		
Hi-milan #1855 (note 7)	50		
Hi-milan #1601 (note 7)			50
Hi-milan #1702 (note 7)			50
Hi-milan #1706		50	

Hi-milan #1707		50	
Stiffness (kg/cm²)	1300	3615	2050
Shore-D scale hardness	60	65	61

(Note 1) Hi-cis-1,4-polybutadiene, manufactured by Japan Synthetic Rubber Co., Ltd.

(Note 2) Yoshinox 425, manufactured by Yoshitomi Seiyaku Co., Ltd.

(Note 3) Manufactured by Ohuchi Shinko Kagaku Co., Ltd.

(Note 4) High-acid ionomer resin, manufactured by Mitsui Polychemical Co., Ltd.

(Note 5) Ionomer resin, manufactured by Mitsui Polychemical Co., Ltd.

(Note 6) High-acid ionomer resin, manufactured by Exxon Co.

(Note 7) Ionomer resin, manufactured by Mitsui Polychemical Co., Ltd.

(Test results)

Table 1

	Example No.			Comparative Example No.		
	1	2	3	1	2	3
Core formulation	I	I	I	I	I	I
Inner cover layer formulation (mm)	A	B	B	C	D	D
Outer cover layer formulation	1.7	1.7	1.7	1.7	1.7	1.7
Outer cover layer thickness (mm)	a	a	c	a	b	a
Spin amount (rpm)	1.9	1.9	1.9	1.9	1.9	1.9
Sand wedge	6450	6400	6320	6200	4500	6100
Driver	2660	2580	2500	2790	2700	2810
Driver flight distance (Carry) (yds)	228.1	229.3	230.5	226.8	227.5	224.6
Feeling	⌒	⌒	⌒	○	×1)	×2)

1) Hard

2) Unsatisfied feeling

The driver flight distance is large in the order of Example 3, Example 2, Example 1, Comparative Example 2, Comparative Example 1

and Comparative Example 3. The driver flight distance increased by using the polyamide for the inner cover layer.

(Test method)

A golf ball produced by using a core, an inner cover layer and an outer cover layer having the following formulations shown in Table 1 was hit with a No.1 wood club (i.e. driver, head speed: 45 m/second) or a sand wedge (head speed: 20 m/second), respectively, and the spin amount and driver flight distance were measured (device: swing robot, manufactured by True Temper Co., Ltd.).

CLAIMS:

1. A golf ball comprising a core (1) and a cover formed on the core, wherein the cover has a two-layer cover structure of a hard inner cover layer (2) and a soft outer cover layer (3), and the inner cover layer (2) comprises a high-rigid polyamide resin in an amount of not less than 5% by weight based on the total weight of the resin.

2. A golf ball according to claim 1, wherein the inner cover layer (2) comprises a mixture of a polyamide resin and an ionomer resin.

3. A golf ball according to claim 1 or claim 2, wherein the ou ter cover layer cover (3) comprises an ionomer resin having a stiffness in the range of from 1000 to 2500 kg/cm^2.

4. A golf ball according to any one of the preceding claims, wherein the inner cover layer (2) has a Shore-D scale hardness in the range of from 60 to 99.

5. A golf ball according to any one of the preceding claims, wherein the outer cover layer (3) has a Shore-D scale hardness in the range of from 56 to 64.

6. A golf ball according to claim 5, wherein the outer cover layer (3) has a Shore-D scale hardness in the range of from 60 to 63.

7. A golf ball substantially as hereinbefore described with reference to Figure 1.

8. A golf ball substantially as hereinbefore described with reference to any one of the Examples 1 to 3.

The Patent Office

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Application No:	GB 9608190.6	**Examiner:**	K. Macdonald
Claims searched:	1-8	**Date of search:**	16 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): C3M(MXC); C3V(VEM)

Int Cl (Ed.6): A63B

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2292387 A	(SUMITOMO RUBBER) see page 7, lines 13-15; page 7, line 25-page 8, line 5;Table 8-Example 7	1 at least
A	GB 2278609 A	(LISCO)	
A	GB 2248067 A	(TAYLOR)	
A	US 4919434	(BRIDGESTONE)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.